

---

# Hearing Conservation



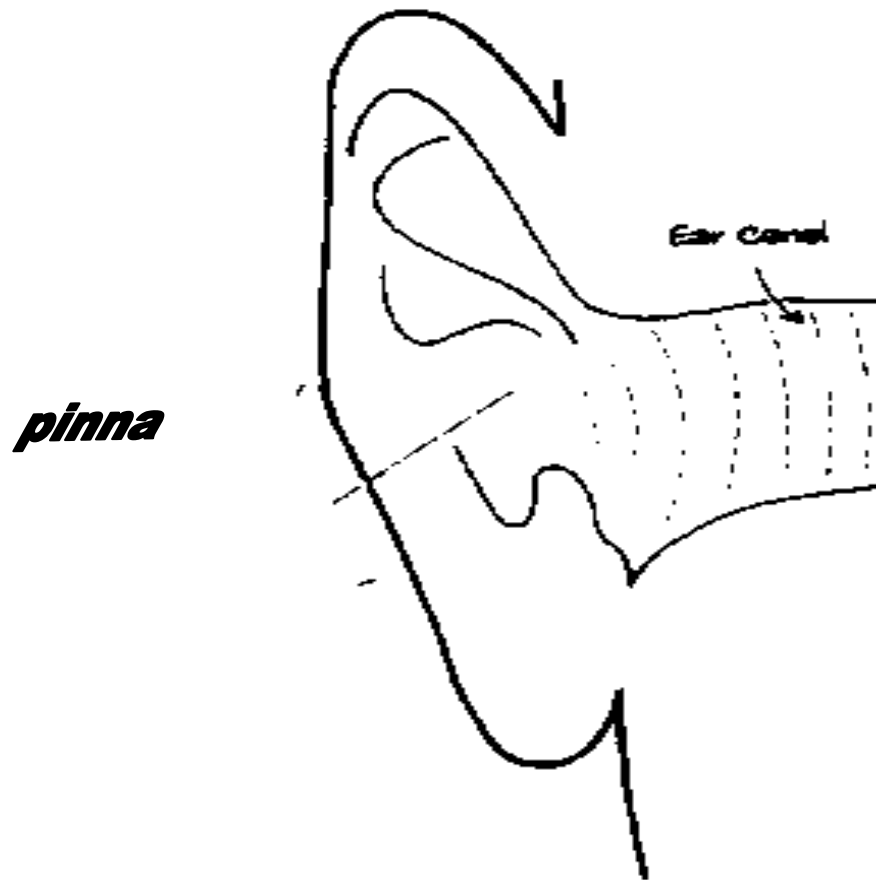
**FERMILAB**

---

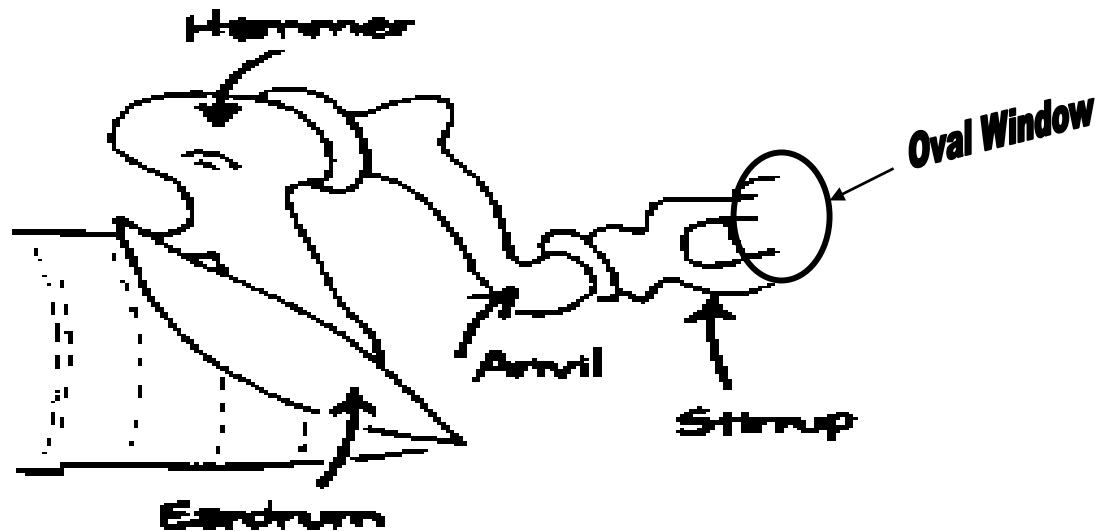
# Objectives

- Anatomy and Physiology of the Human Ear
- What is considered hazardous noise
- Sound level measurement
- How noise effects the ability to hear
- The Elements of Fermilab's Hearing Conservation Program
- Ways to protect your hearing
- Q & A

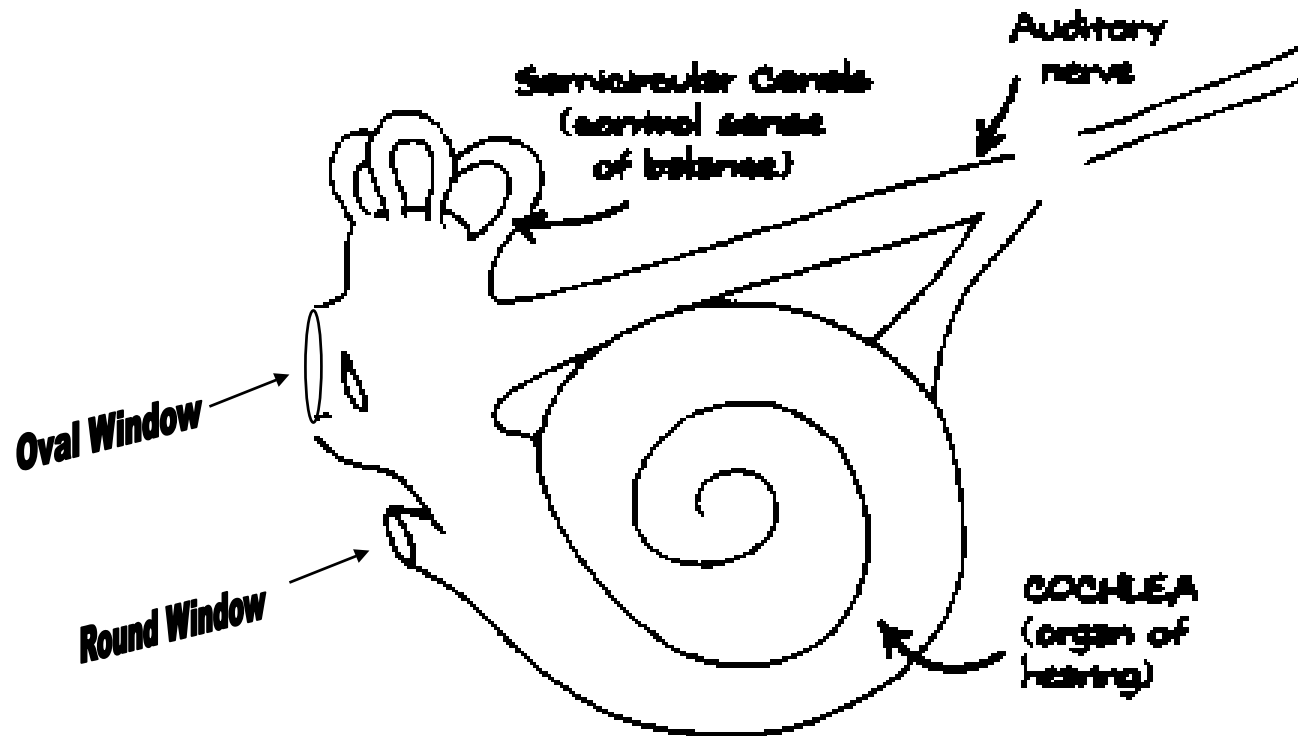
# Outer Ear



# Middle Ear



# Inner Ear



# Nerve Cells



Normal



Damaged

# Permissible Exposure Limits for “Continuous” Noise

T, Duration per Day (hours)	SPL Sound Pressure Level (dBA)
32	80
16	85
8	90
4	95
2	100
1	105
1/2	110
1/4	115

---

# Sound level measurement

- Sound level meter (SLM)
- Noise Dosimetry

---

# Typical A Weighted Sound Levels

- **80**            **Vacuum Cleaner**
- **70**
- **60**            **Conversation at 1 m**
- **50**            **Urban Residence**
- **40**
- **30**            **Soft Whisper at 2 m / Rice Krispies**
- **20**            **North Rim of Grand Canyon**
- **10**
- **0**            **Threshold of Hearing (1000Hz)**

---

# Typical A Weighted Sound Levels

- **140**            **Threshold of Pain**
- **130**
- **120**            **Jet Takeoff at 100 m**
- **110**            **Rock Concert**
- **100**            **Jackhammer at 15 m**
- **90**             **Drilling Concrete**
- **85**             **Heavy Truck at 15 m**

# Typical A-Weighted Sound Levels

80	TORO Ground Master 72 Riding Mower (87 dBA)
70	Personnel Dosimetry Results {near compressors and performing some grinding operations (73dBA-77 dBA) IB-1 Shop Area (68dBA-70dBA) During Drilling Operations
60	
50	
40	
30	Lab Audiometric Testing Booth (< 25 dBA)
20	
10	

# Typical A-Weighted Sound Levels

140 Threshold of Pain

130

120

110 Testing of Fire Alarm System in FCC

100 MRRF - F0 Compressor Room

CHL Nitrogen Plant

90 TORO Grounds Master 322-D Riding Mower

TORO TV5004 Master Push Mower

CUB Lab D Compressor Room

CDF A/C units CHL Chiller Room

**Time Weighted  
Average  
Exposure (dBA)**

**Employee Population  
Experiencing  
Hearing Loss (%)**

<b>&lt; 80</b>	<b>0</b>
<b>80</b>	<b>5</b>
<b>85</b>	<b>10</b>
<b>90</b>	<b>20</b>
<b>100</b>	<b>~100</b>
<b>&gt;100</b>	<b>100</b>

---

# Effects of Hearing Loss

- Everybody Mumbling
- Communication with people
- Tinnitus

---

# The 4 P's of Hearing Loss

- **Progressive**
- **Painless**
- **Permanent**
- **Preventable**

---

# Fermilab Hearing Conservation

- Annual Training
- Annual Audiometric Testing
  - Baseline Hearing Test
  - Annual Hearing Test
  - Medical Department
- Accessibility to Hearing Protection
- Sound Level Measurements/Audiodosimetry

---

# Hearing Protection Devices (HPD)

- **Ear Muffs**
- **Ear Plugs**
  - **Pinna Pull**
  - **Roll and Fit**
- **Occlusion Effect**
- **Hear better in louder environments**

# Q & A

- **How can I tell when a noise may be harmful to my ears?**
- **I don't need hearing protection, I am used to the noise!**
- **Do earmuffs block out noise better than earplugs?**

---

# Q & A

- **I've already lost some or most of my hearing: why should I have to wear hearing protection?**
- **What is the Noise Reduction Rating and what does it mean?**

---

# Summary

- Anatomy and Physiology of the Human Ear
- What is considered hazardous noise
- Sound level measurement
- How noise effects the ability to hear
- The Elements of Fermilab's Hearing Conservation Program
- Ways to protect your hearing
- Q & A